

PATENT

Atty Docket No.: 200208028-1

App. Ser. No.: 10/620,272

IN THE CLAIMS:

Please find below a listing of all of the pending claims. The statuses of the claims are set forth in parentheses.

1. (Original) A device comprising:
 - a signal module configured to transmit a first type of signal and a second type of signal, said signal module further configured to receive the first type of signal and the second type of signal;
 - a timer; and
 - a controller configured to operate the signal module and timer,wherein said controller is operable to determine a location of the device with respect to another device based upon the time elapsed between transmission and receipt of the first type of signal and transmission and receipt of the second type of signal.
2. (Original) The device according to claim 1, further comprising:
 - at least one sensor configured to detect one or more environmental conditions.
3. (Original) The device according to claim 2, wherein said one or environmental conditions comprises at least one of temperature, pressure, humidity, air flow direction, and air flow velocity.
4. (Original) The device according to claim 2, further comprising:
 - a data module configured to transmit detected by the at least one sensor and to receive information from the component.
5. (Original) The device according to claim 4, wherein said data module is configured to transmit identification information to the component and to receive identification information from the component.

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6. (Original) The device according to claim 1, wherein said signal module comprises an RF transmitter configured to transmit an RF signal and an RF receiver configured to receive an RF signal.

7. (Original) The device according to claim 1, wherein signal module comprises an ultrasonic transmitter configured to transmit an ultrasonic signal and an ultrasonic receiver configured to receive an ultrasonic signal.

8. (Original) The device according to claim 1, wherein the signal module comprises a first transmitter configured to transmit the first type of signal and the receiver comprises a first receiver configured to receive the first type of signal, and wherein the signal module further comprises a second transmitter configured to transmit the second type of signal and a second receiver configured to receive the second type of signal.

9. (Original) The device according to claim 1, wherein the signal module comprises one or more transceivers.

10. (Original) A method of communicating between a plurality of devices, said method comprising:

transmitting a first type of signal and starting a timer, wherein said first type of signal is transmitted from a first device to a second device;

receiving said first type of signal and stopping the timer, wherein said first device receives said first type of signal from the second device;

determining the time elapsed between transmission of the first type of signal and receipt of the first type of signal;

determining the distance between the first device and the second device based upon the time elapsed between transmission and receipt of the first type of signal;

transmitting a second type of signal and starting the timer, wherein the second type of signal is transmitted from the first device to the second device;

receiving said second type of signal and stopping the timer, wherein said first device receives said second type of signal from the second device;

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determining the time elapsed between transmission of the second type of signal and receipt of the second type of signal; and

calculating the distance between the first device and second device based upon the time elapsed between the transmission and receipt of the first type of signal and the transmission and receipt of the second type of signal.

11. (Original) The method according to claim 10, further comprising:

repeating the transmission and receipt of the first type of signal and the second type of signal a predetermined number of times; and

averaging the calculated distances based upon the elapsed times for transmission and receipt of the first type of signal and the second type of signal.

12. (Original) The method according to claim 10, wherein said step of determining the distance between the first device and the second device based upon the time elapsed between transmission and receipt of the first type of signal comprises subtracting a predetermined time required for the second device to receive and transmit the first type of signal; and wherein said step of determining the time elapsed between transmission of the second type of signal and receipt of the second type of signal comprises subtracting a predetermined time required for the second device to receive and transmit the second type of signal.

13. (Original) The method according to claim 10, further comprising:

calculating the distance between the first device and a third device;

calculating the distance between the second device and the third device;

calculating the distance between one or both of the first device and the second device and a fourth device;

calculating the distance between the third device and the fourth device; and

triangulating the location of the third device with respect to the first device and the second device based upon the distance of the third device from the first device, the second device and the fourth device.

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14. (Original) The method according to claim 13, further comprising:
triangulating the location of the fourth device with respect to the first device, the second device and the third device based upon the distance of the fourth device from the first device, the second device and the third device.

15. (Original) The method according to claim 14, further comprising:
plotting the locations of the devices on a map or grid.

16. (Original) The method according to claim 15, wherein said step of plotting the device locations comprises referencing at least one of said devices to a fixed point of reference.

17. (Original) The method according to claim 15, further comprising:
transmitting identification information from the first device to the second device;
transmitting identification information from the second device to the first device; and
storing the identification information from the first device and the second device to thereby enable relatively simple identification of the first device and the second device.

18. (Original) A computer readable storage medium on which is embedded one or more computer programs, said one or more computer programs implementing a method of communicating between a plurality of devices, said one or more computer programs comprising a set of instructions for:

transmitting a first type of signal and starting a timer, wherein said first type of signal is transmitted from a first device to a second device;

receiving said first type of signal and stopping the timer, wherein said first device receives said first type of signal from the second device;

determining the time elapsed between transmission of the first type of signal and receipt of the first type of signal;

determining the distance between the first device and the second device based upon the time elapsed between transmission and receipt of the first type of signal;

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transmitting a second type of signal and starting the timer, wherein the second type of signal is transmitted from the first device to the second device;

receiving said second type of signal and stopping the timer, wherein said first device receives said second type of signal from the second device;

determining the time elapsed between transmission of the second type of signal and receipt of the second type of signal; and

calculating the distance between the first device and second device based upon the time elapsed between the transmission and receipt of the first type of signal and the transmission and receipt of the second type of signal.

19. (Original) The computer readable storage medium according to claim 18, said one or more computer programs further comprising a set of instructions for:

repeating the transmission and receipt of the first type of signal and the second type of signal a predetermined number of times; and

averaging the calculated distances based upon the elapsed times for transmission and receipt of the first type of signal and the second type of signal.

20. (Original) The computer readable storage medium according to claim 18, said one or more computer programs further comprising a set of instructions for:

calculating the distance between the first device and a third device;

calculating the distance between the second device and the third device;

calculating the distance between one or both of the first device and the second device and a fourth device;

calculating the distance between the third device and the fourth device; and

triangulating the location of the third device with respect to the first device and the second device based upon the distance of the third device from the first device, the second device and the fourth device.

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21. (Original) The computer readable storage medium according to claim 20, said one or more computer programs further comprising a set of instructions for:

triangulating the location of the fourth device with respect to the first device, the second device and the third device based upon the distance of the fourth device from the first device, the second device and the third device.

22. (Original) The computer readable storage medium according to claim 21, said one or more computer programs further comprising a set of instructions for:

plotting the locations of the devices on a map or grid.

23. (Original) The computer readable storage medium according to claim 22, said one or more computer programs further comprising a set of instructions for:

referencing at least one of said devices to a fixed point of reference.

24. (Original) The computer readable storage medium according to claim 18, said one or more computer programs further comprising a set of instructions for:

transmitting identification information from the first device to the second device;

transmitting identification information from the second device to the first device; and

storing the identification information from the first device and the second device to thereby enable relatively simple identification of the first device and the second device.

25. (Currently amended) A device comprising:

means for transmitting and receiving a first type of signal;

means for transmitting and receiving a second type of signal;

means for timing the transmission and receipt of the first type of signal transmitted and received by the means for transmitting and receiving the first type of signal;

means for timing the transmission and receipt of the second type of signal transmitted and received by the means for transmitting and receiving the second type of signal; and

means for calculating a distance between the device and another device based upon in response the times obtained by the means for timing the transmission and receipt of the first

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type of signal ~~timing-means~~ and the means for timing the transmission and receipt of the
second type of signal ~~timing-means~~.

26. (Original) The device according to claim 25, further comprising:
means for transmitting and receiving data.

27. (Original) The device according to claim 25, further comprising:
means for detecting one or more environmental conditions; and
means for transmitting detected one or more environmental conditions.

28. (Original) The device according to claim 25, further comprising:
means for plotting locations of one or more devices.

29. (Original) A plurality of devices comprising:
a communication system to enable communication between said device and others of
said plurality of devices having communication systems;

said plurality of devices being positioned at various locations of a room, wherein said
plurality of devices are configured to communicate with one another through said
communication systems;

wherein said plurality of devices are configured to determine their positions with
respect to others of said plurality of devices through said communication systems;

at least one sensor configured to detect one or more conditions, wherein said plurality
of devices are configured to communicate the detected one or more conditions to others of
said plurality of devices; and

one or more of said plurality of devices being in communication with a cooling
system configured to supply cooling fluid to one or more heat generating components in the
room, wherein said cooling system is configured to be manipulated in response to the
detected one or more conditions.

30. (Original) The plurality of devices according to claim 29, wherein said plurality
of devices are configured to communicate through wireless connections.

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31. (Original) The plurality of devices according to claim 29, wherein said one or more conditions comprises at least one of temperature, humidity, pressure, air flow, and vibration.

32. (Original) The plurality of devices according to claim 31, wherein said cooling system is operable to supply cooling fluid to a plurality of racks, said cooling system having a controller in communication with one or more of said plurality of devices.

33. (Original) The plurality of devices according to claim 32, wherein said cooling system comprises a cooling system controller and a variable capacity compressor, wherein said cooling system controller is configured to vary the capacity of the variable capacity compressor substantially based upon information received from the plurality of devices.

34. (Original) The plurality of devices according to claim 32, further comprising:
a mobile environmental condition sensing device having a communication device configured to communicate with said plurality of devices to enable location of said mobile environmental condition sensing device with respect to said plurality of devices.

35. (Original) The plurality of devices according to claim 34, wherein said communication device is further configured to transmit detected condition information to one or more of said plurality of devices.

36. (Original) The plurality of devices according to claim 29, wherein said cooling system comprises a cooling fluid delivery component, wherein said cooling fluid delivery component is configured to vary cooling fluid delivery based upon detected condition information received from one or more devices.

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37. (Original) A method of controlling environmental conditions in a data center, said method comprising:

- receiving location information from a plurality of devices configured to determine their locations with respect to others of said plurality of devices;
- mapping the locations of the plurality of devices;
- associating the devices with components in the data center;
- receiving at least one environmental condition from one or more of the plurality of devices;
- determining whether the received at least one environmental condition is within a predetermined range; and
- manipulating one or more cooling system components in response to the received at least one environmental condition being outside of the predetermined range.

38. (Original) The method according to claim 37, wherein said step of associating the plurality of devices with components in the data center comprises receiving identification information from the plurality of devices and comparing the identification information with a database containing a correlation between the identification information and the components.

39. (Original) The method according to claim 37, wherein said step of associating the plurality of devices with components in the data center comprises receiving information pertaining to the association of the plurality of devices and the components from the plurality of devices.

40. (Original) The method according to claim 37, wherein said manipulating step comprises increasing the volume flow rate of cooling fluid to those components having temperatures exceeding a predetermined operating temperature range.

41. (Original) The method according to claim 37, wherein said manipulating step comprises decreasing the volume flow rate of cooling fluid delivered to those components having temperatures that fall below a predetermined operating temperature range.

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42. (Original) The method according to claim 37, wherein said manipulating step comprises increasing at least one of temperature and volume flow rate of cooling fluid from a cooling system component in response to a decrease in cooling fluid supply to one or more racks falling below an increase in cooling fluid supply to the one or more racks.

43. (Original) The method according to claim 37, wherein said manipulating step comprises decreasing at least one of temperature and volume flow rate of cooling fluid from a cooling system component in response to a decrease in cooling fluid supply to one or more racks exceeding an increase in cooling fluid supply to the one or more racks.

44. (Original) The method according to claim 37, further comprising:
performing a numerical modeling of a temperature distribution and flow characteristics of the data center; and
manipulating said one or more cooling system components in response to said numerical modeling.

45. (Original) The method according to claim 44, further comprising:
implementing said numerical modeling to correlate at least two of temperature, velocity and pressure of said cooling fluid and power draw of one or more racks within said data center to thereby infer a thermal condition throughout said data center, wherein said manipulating step further comprises manipulating said one or more cooling system components in response to said inferred thermal condition.

46. (Original) A computer readable storage medium on which is embedded one or more computer programs, said one or more computer programs implementing a method of controlling environmental conditions in a data center, said one or more computer programs comprising a set of instructions for:

receiving location information from a plurality of devices configured to determine their locations with respect to others of said plurality of devices;
mapping the locations of the plurality of devices;
associating the devices with components in the data center;

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receiving at least one environmental condition from one or more of the plurality of devices;

determining whether the received at least one environmental condition is within a predetermined range; and

manipulating one or more cooling system components in response to the received at least one environmental condition being outside of the predetermined range.

47. (Original) The computer readable storage medium according to claim 46, said one or more computer programs further comprising a set of instructions for:

receiving identification information from the plurality of devices and comparing the identification information with a database containing a correlation between the identification information and the components.

48. (Original) The computer readable storage medium according to claim 46, said one or more computer programs further comprising a set of instructions for:

receiving information pertaining to the association of the plurality of devices and the components from the plurality of devices.

49. (Original) The computer readable storage medium according to claim 46, said one or more computer programs further comprising a set of instructions for:

increasing the volume flow rate of cooling fluid to those components having temperatures exceeding a predetermined operating temperature range.

50. (Original) The computer readable storage medium according to claim 46, said one or more computer programs further comprising a set of instructions for:

decreasing the volume flow rate of cooling fluid delivered to those components having temperatures that fall below a predetermined operating temperature range.

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51. (Currently amended) A system for controlling environmental conditions in a data center, said method comprising:

means for locating a plurality of devices configured to determine their locations with respect to others of said plurality of devices, wherein said plurality of devices are configured to detect one or more environmental conditions;

means for mapping the locations of the plurality of devices;

means for associating the devices with components in the data center;

means for communicating the detected one or more environmental conditions;
receiving

means for determining whether the received ~~at least one~~ or more environmental conditions are ~~[[is]]~~ within a predetermined range; and

means for manipulating one or more cooling system components in response to the received ~~at least one~~ or more environmental conditions being outside of the predetermined range.

52. (Original) The system according to claim 51, further comprising:

means for transmitting and receiving identification information from the plurality of devices; and

means for comparing the identification information with a database containing a correlation between the identification information and the components.

53. (Original) The system according to claim 51, further comprising:

means for receiving information pertaining to the association of the plurality of devices and the components from the plurality of devices.

54. (Original) The system according to claim 51, further comprising:

means for varying the volume flow rate of cooling fluid to those components having temperatures exceeding a predetermined operating temperature range.